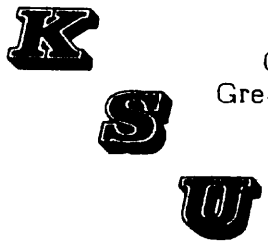

Growing Vegetables and Flowering Plants in a Greenhouse Supplied with Swine-building Exhaust Air

J.K. Greig[1], C.K. Spillman[2], and B.A. Koch[3]

Summary

Exhaust air from a Kansas State University swine-farrowing house provides CO_2 and possibly other gases that are being used by vegetable plants in a KSU greenhouse. In addition, a rock-storage system reduces fuel requirements of the greenhouse. Tomatoes and cucumbers have been the major food crops studied, but transplant production of geraniums, marigolds, snapdragons, and calendula also has been studied. Poinsettias were grown as a fall crop in 1980 and again in 1982.

Introduction

The project objectives are: 1) To evaluate the production, quality, and acceptance of greenhouse crops grown in hog house air. 2) To determine if exhaust air from a hog house can be used economically to improve use of solar energy in a greenhouse by recirculating air between the greenhouse and the hog house. 3) To compare the fossil fuel needed to maintain temperature in a conventional greenhouse with that needed in a greenhouse supplied with exhaust air from a swine building. 4) To estimate the reduction in fuel per unit of cucumbers, tomatoes, or other crops produced in a greenhouse-hog house unit equipped with solar-energy storage, compared with that used in a conventional greenhouse.

Procedures

Two greenhouses, both 6 m x 7.3 m (20 ft x 24 ft), double layered, inflated polyethylene, were used in both 1980-81 and 1981-82 to grow Sandra cucumbers in the fall and Tuckcross 520 tomatoes in the spring. In the fall study of 1980 and 1982, V-14 poinsettias were also grown. Instead of using soil for a growth medium, we used a synthetic soil medium and fertilized the plants by applying Osmocote 14-14-14 (a slow-release fertilizer) at various rates. In the spring we compared 3 spacings in Speedling flats for four kinds of bedding plants: geraniums, calendula, marigolds, and snapdragons.

One experimental greenhouse attached to a swine-finishing unit during the fall of 1980 and spring of 1981 and to a farrowing house since then receives exhaust air from the swine building. Excess solar energy collected in that greenhouse is stored in a rock-storage system containing about 1 cubic meter of rock for each 6 square meters of greenhouse floor space. The control greenhouse, attached to a headquarters building, has neither energy storage nor air from the swine-finishing building.

[1]Department of Horticulture
[2]Department of Agriculture Engineering
[3]Department of Animal Sciences and Industries

Results and Discussion

The cucumber, tomato, poinsettia, and bedding plants grown in the experimental house all had darker leaves than those grown in the control house.

The greenhouse-forcing cucumbers and tomato plants all grew and set fruit abundantly. The foliage, however, became necrotic late in the season and the yields were unfavorable, probably because of mineral nutrition or excess ammonia in the experimental house.

Tomato yields in both greenhouses were low because of blossom end-rot in the spring of 1981, but were lower in the experimental house. For the spring 1982 crop, calcium nitrate was used as a nitrate source and the additional calcium seemed to control the blossom end-rot. A higher number of deformed tomatoes in the experimental than in the control greenhouse could have resulted from excess nitrogen, part of which was probably from ammonia in the farrowing house ventilating air. In the fall of 1982 we are reducing the farrowing house air brought into the greenhouse by 50 percent. Since we have had necrotic leaves on both tomatoes and cucumbers late in the season when ventilation was reduced, we are attempting to see if we can grow better quality plants with a reduced input of farrowing house air.

In the fall, poinsettias which had different nutrition levels applied at different times, all produced high-quality plants in both experimental and control greenhouses in 1980. The plants in the control house with the lowest fertilizer level had yellowish leaves, indicating a nitrogen deficiency. That did not occur for plants in the experimental house, either because of the higher CO_2 level or because ammonia was taken up by the plant and converted to nitrogen. Bract color of the plants was comparable between the houses. Plants removed from the experimental house had a typical swine-house odor and the bracts appeared more pink than red. The plants had been watered by applying water only to the pots. Using a nozzle to spray the plants with water removed dust from the bracts; the pink became red and the odor (which evidently was in the dust) was gone.

The results of this study indicated that high-quality poinsettias can be grown in the experimental house, but an overhead irrigation system for hosing down the plants prior to removing them from the house will be necessary to remove the dust and odor. This study is being repeated at the present time.

We have been very successful in growing four kinds of bedding plants: geraniums, calendula, marigolds and snapdragons. These plants were grown in Speedling flats of 1, 2, or 3 inch cells containing Jiffy Mix Plus as the medium. In both years, plants in the experimental greenhouse were larger and darker green in color. They also bloomed earlier than plants grown in the control greenhouse. As cell size increased dry weight of the transplants increased in both houses.

In growing flowering bedding plants or broccoli transplants we have been completely successful with no problems. In all cases the plants grew better in the experimental house with the only difference between houses being the addition of the hog house air. Temperatures, nutrition and watering were all the same. It took about one-third less time to grow transplants to "garden setting size" in the experimental house and the plants also bloomed earlier than those grown in the control greenhouse. Less fuel was used to heat the experimental house because of the solar energy storage unit and the heat in the ventilating air from the farrowing house.